The Role Of Nuclear Cardiology For Management Decisions In Chronic Cad

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While Nuclear Cardiology was initially utilized for detection of coronary artery disease in recent times it has been more commonly used for purpose of risk stratification and guiding patients management . Patients with clear cut angina generally do not require Nuclear Cardiology studies prior to catherterization . However in patients with an intermediate or high likelihood of coronary artery disease and minor symptoms the decision for coronary angiography is related to patients risk of cardiac death and revascularisation procedures (1) . Since Nuclear Cardiology provides an objective method of evaluating many of the determinants of prognosis of coronary artery disease , these tests are well suited guiding this patients management decision. Gated rest stress myocardial perfusion SPECT using either exercise or pharmacological stress can be used to objectively quantify the amount of infracted or hibernating myocardium and the amount of jeopardized myocardium (related to the extent of coronary artery disease) and the degree of jeopardy (related to the severity of coronary artery stenoses) . Additionally there is evidence that these procedures provide information regarding stability and instability of coronary artery disease . An extensive body of literature has defined several features of myocardial perfusion SPECT with respect to risk assessment including the following a normal test result is associated with a less than one percent likelihood of cardiac death or non-fatal myocardial infarction in a variety of patients subsets for atleast a one year period of time (1,2). There is an increasing mortality rate with increasing extent and severity of stress perfusion defect. Patients

undergoing adenosine stress appeared to have a higher risk for all types of scan findings than an patients undergoing exercise stress probably related to the underlying increased risk of patients who require pharmacological stress. Clinically useful risk stratification patients with left bundle branch block, left ventricular hypertrophy, intermediate risk duke treadmill score after cardiac surgery and after equivocal angiography (1-3). The use of step wise strategy in which patients with chronic chest pain syndromes are first analyzed by nuclear testing and then selectively sent to catheterization has been demonstrated to be more cost effective than direct catheterizing patients with chronic chest pain. Recently it has been demonstrated that by combing perfusion information from myocardial perfusion SPECT with functional information derived from gated SPECT improved risk stratification using Nuclear Cardiology is possible. Beyond the extent and severity of stress perfusion defects, assessment of ejection fraction (4) and ventricular volumes (5) play an important role.

The most recent trend in the use of Nuclear Cardiology procedures is in predicting the response to therapy. Beyond assessing patients risk, it is clinically important to assess information regarding other revascularisation would be likely to result in a reduction of this risk. In this regard, recent data from Cedars-Sinal Medical Centre demonstrated that amount of ischemia have a lower mortality rate with medical therapy whereas patients with extensive stress induced ischemia have lower mortality rate with revascularisation therapy (6). Clinicians appear to understand the relationship between the extent of ischemia and the likelihood of the patients undergoing coronary angiography and revascularisation . While there is an increased mortality rate with decreasing ejection fraction, the functional information alone is not predictive of the likelihood of benefit from revascularisation . Even in amount of stress-induced ischemia appears to provide this information regarding therapeutic benefit from revascularisation (7).

Finally while it is well recognized that a normal nuclear scan denotes a low risk the duration or 'warranty period' for this low risk varies according to patient group. Particularly elderly patients with history of coronary artery disease are a group in which the warranty period is considerably shorter than in other subsets(8).

In summary, Nuclear Cardiology studies are high useful in determining the need of catherterization and revascularisation in patients with no unexpected chronic coronary artery disease when they do not have major symptoms. It should be noted however than in addition to a

comprehensive assessment of nuclear variables that can be derived from gated SPECT , a wide variety of non-nuclear findings need to be taken into account in arriving at the appropriate decision regarding management of an individual patients

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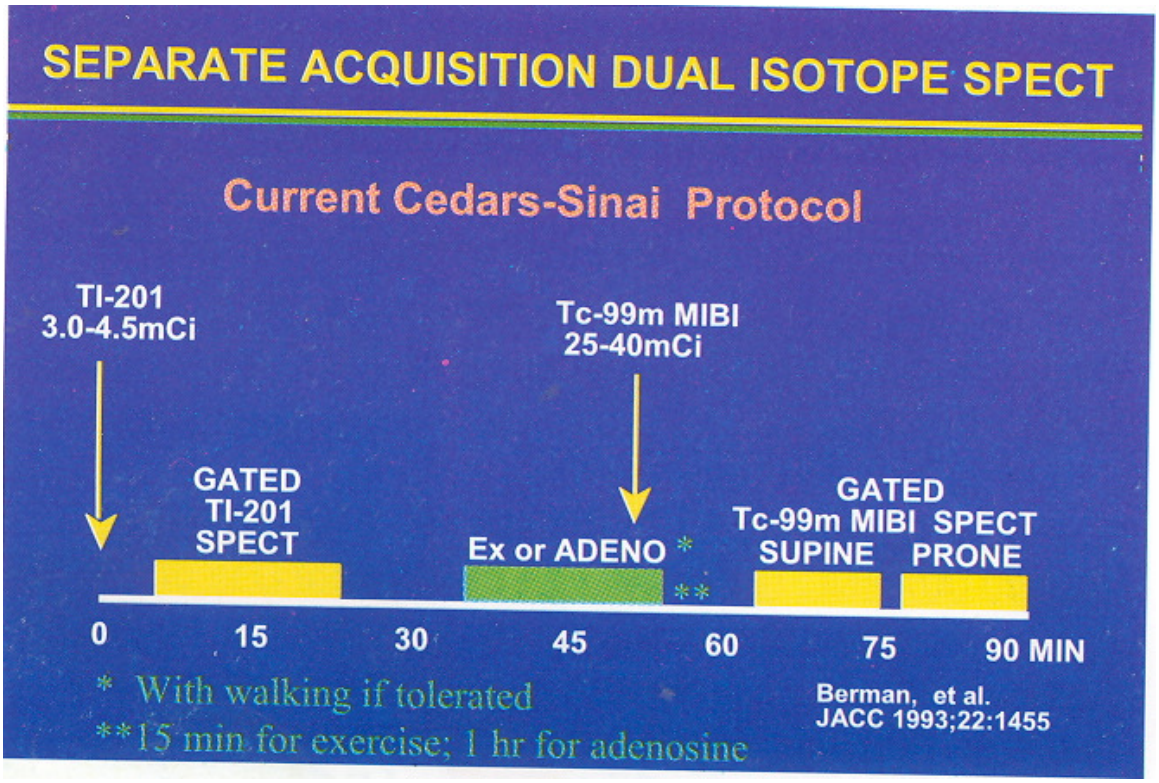
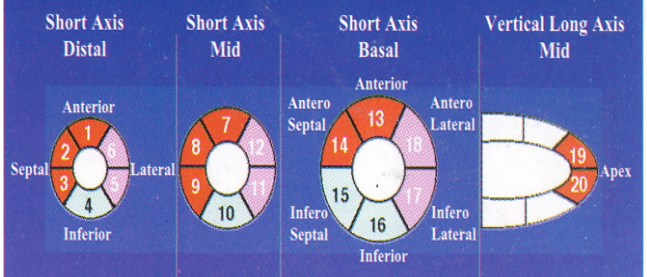


Myocardial Perfusion SPECT 20-Segment Scoring



0 = Normal
1 = Slight reduction of uptake
2 = Moderate reduction of uptake
3 = Severe reduction of uptake
4 = Absent of radioactive uptake

LAD LCX RCA

DEFINITION OF SCINTIGRAPHIC INDICES

SUMMED SCORES

- SUMMED STRESS SCORE (SSS)*: SUM OF STRESS SCORES OF THE 20 SEGMENTS
- SUMMED REST SCORE (SRS)*: SUM OF REST SCORES OF THE 20 SEGMENTS
- SUMMED DIFFERENCE SCORE (SDS)*: SSS - SRS

DEGREE OF ABNORMALITY BY SSS CATEGORY

< 4	NORMAL
4 - 8	MILDLY ABNORMAL
9 - 13	MODERATELY ABNORMAL
> 13	SEVERELY ABNORMAL

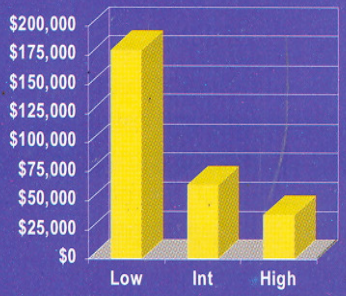
* INCORPORATES EXTENT AND SEVERITY OF DEFECTS

BERMAN, et al ACC 1996

Cost-Benefit of Nuclear Testing

Cost per HE Detected

Assumptions:
Nuclear Cost:
$840
Cath Cost:
$2800
All abnl scans are referred to cath

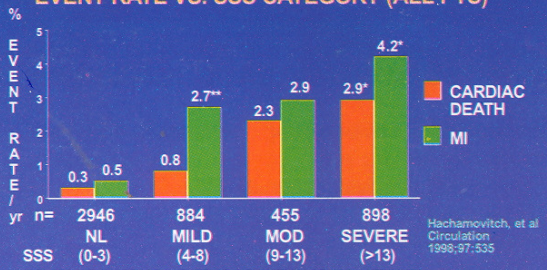


Pre-Scan Lk CAD

Berman et al, JACC 1995;26:639-47

PREDICTION OF MI VS. CARDIAC DEATH BY MYOCARDIAL PERFUSION SPECT

EVENT RATE VS. SSS CATEGORY (ALL PTS)



Hachamovitch, et al Circulation 1998;97:535

* SIGNIFICANT INCREASE IN RATE AS A FUNCTION OF SSS CATEGORY
** SIGNIFICANT DIFFERENCE IN RATE OF MI VS. DEATH

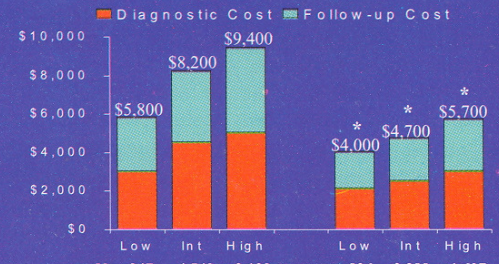
MPS for Risk Stratification in Chronic CAD

Specific patient subsets

- Elderly
- Women
- Diabetics
- LBBB, LVH
- Intermediate Duke Treadmill Score
- After MI
- After revascularization
- Before non-cardiac surgery
- After equivocal angiography

Adapted from ACC/AHA/ACP-ASIM Chronic Stable Angina Guidelines JACC 1999

Comparative Cost Between Screening Strategies

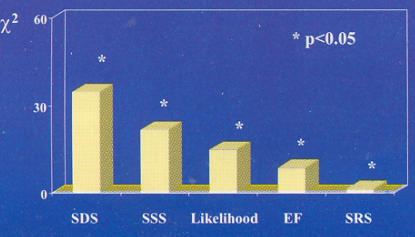


*p<0.01 vs Cath

Shaw et al. JACC 1999;33:661

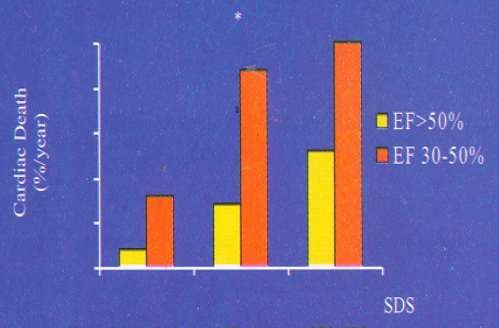
Gated SPECT and prediction of non-fatal MI

Univariate Cox Proportional Hazards Regression



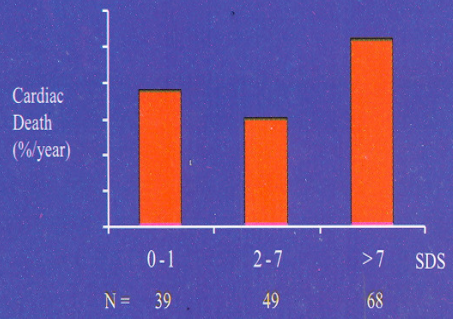
Sharir et al, JNM 2001;42:831-7

Cardiac Death Rate as a Function of the Amount of Ischemia in Patients with EF?30%



Sharir et al, JNM 2001;42:831-7

Cardiac Death Rate as a Function of the Amount of Ischemia in Patients with EF<30%



Sharir et al, JNM 2001;42:831-7

Risk Assessment in Chronic CAD

Importance of Integration of Test Results

Non-nuclear	Nuclear
Symptoms/clinical presentation	Extent & severity of perfusion defects
Exercise duration	stress, rest, late
Exercise hypotension	Lung uptake
Heart Rate Recovery	TID
Duke Treadmill Score	LV function
Type of stress	LVEF
Angiographic findings	LV Volume